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ERRATA.

VOL. 11, NO. 4.

Page 99, paragraph 2, line 7.—For "*Rhinoscapha oblita*" read *R. lagopyga* Frm.

Page 101, paragraph 2.—For reference "(10)" read (6).

Page 117, last paragraph, line 5.—For "*ventricosus*" read *variegatus*.

AGRICULTURAL JOURNAL

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DEPARTMENT OF AGRICULTURE, FIJI.

VOL. 12.] MARCH, 1941. [No. 1.

EDITORIAL.

THE deliberations of the Copra Conference recently held in Sydney are anxiously awaited by many who have vital interests in the copra industry. Unfortunately, it is not yet possible to make public the results of the Conference until all the Governments concerned have signified their agreement in principle with the conclusions reached at the Conference. The constitution of the Conference has already been made public in the local press and in the *Pacific Islands Monthly* for January and so need not be further described, save that it is hoped that this first Conference of all administrations in the Pacific will lead the way to further co-operation amongst all the territories concerned.

Every possible angle of the copra industry was reviewed and much valuable information was co-ordinated at the Conference, but the main problems were, of course, those of finding markets and of obtaining ships in which to carry the product.

In the meantime, merchants, Government and private interests have examined all their resources in order to find new uses for copra and new markets, and some progress has been made—in fact a material quantity of copra has been shipped during the past few months

The value of copra in pig-raising has been investigated in New Zealand and that Government has arranged for a certain percentage of the produce of Western Samoa to be utilised for this purpose. No doubt similar use will be made of copra from other territories.

The development of a coconut oil mill in Canada capable of dealing ultimately with 50,000 tons of Pacific copra annually is being watched with keen interest, and should prove very helpful to the industry.

The use of coconut oil as engine fuel has been tested with satisfactory results, but the cost of producing coconut oil is doubtfully economic, compared with mineral fuel oils, except in emergency periods like the present.

Other additional avenues available for the utilisation of coconut products that have been tried locally include the extension of local soap making, the manufacture of charcoal, the provision of cooking oil, the use of coconut oil as a lubricant and for the manufacture of glycerine and other uses. These efforts indicate the very wide range of products that can be derived from the coconut, but local uses are too restricted in volume to have any marked influence on general consumption and on world prices for the commodity, and hence, the need for co-operation between all Pacific territories is emphasised.

In opening the Copra Conference, the Chairman (the Honourable T. J. Collins, Australian Minister in Charge of External Territories) said "I sincerely hope that out of this Conference will come a plan which will continue

in perpetuity and provide methods of joint marketing of the products of South Pacific territories. I consider that if we are to properly discharge our obligations to these Pacific Islands territories in the future, there must be regular co-operative action in the profitable marketing of their products. We cannot expect to hold these rich territories unless we develop and make use of their abundant resources. This can be accomplished best by united action among the South Pacific Governments concerned, rather than by isolated and sporadic efforts by individual Governments." All who have copra interests and the development of island territories at heart will gladly endorse the words of the Chairman of the Conference and look forward eagerly to the materialisation of the proposals put forward by the Conference as soon as they can be made public.

An important article on pig-feeding appears in this issue and indicates the wide range of foodstuffs locally available to breeders and, more important still, the way to balance the rations so that animal development may proceed on rational and desirable lines in order to satisfy all market requirements. The article briefly outlines the essential food requirements of pigs as being water, fats or oils, proteins, carbohydrates, crude fibre, mineral matter and vitamins and shows how these may be combined to provide a balanced ration, which is absolutely necessary, if healthy carcases of good quality are to be produced.

The list of foodstuffs indicates that economic rations are available to all classes of breeders and examples are given of rations suitable to dairymen, coconut planters and others which should prove useful as affording practical instruction in the preparation of a balanced diet. It is expected that this article prepared by an officer of long local practical experience will be carefully studied by all who are interested in this potential industry, which, it is hoped, may prove a boon to coconut planters, in particular, as well as to others. It may be mentioned that negotiations are progressing with a view to obtaining for Fiji a small share in the pig market of the United Kingdom. In these times such negotiations are naturally protracted but the position is not without hope, though much patience is needed.

A useful note regarding the handling and transport of turkeys for the local market is also included in this issue and it is hoped that persons interested in this trade, which might be expanded, will find it of practical interest.

An interesting article by an officer of the Forestry Department deals with experiments designed to eliminate the blue stain from timber commonly used in making packing cases used for the banana trade.

Many gardeners in Suva find tomato growing a rather profitless task, as wilt is so apt to claim a large proportion of the crop. The article on tomato growing on the black soapstone soils of Viti Levu has been written out of the long experience of a successful and enthusiastic gardener and should prove valuable to growers of this esteemed article of diet.

It is well known that improvements in agriculture in a rural Colony go hand in hand with improved nutrition of the people and notes on "Agriculture and Nutrition" in this issue will be read with much interest by all who have the good of the local race at heart. These notes indicate that efforts are being made on agricultural stations to combine improved agricultural practice with improvement in the diet of the workers. The immense benefits of mixed farming with its beneficial production of protective foods, principally meat, milk and milk products, eggs, roots, vegetables and fruit is stressed not only because of the cheapness of such foods to producers, but because

such primary producers usually prove more contented, stable and loyal citizens. A dietary table is given showing how locally available foods can best be proportioned to give an adequate and balanced diet and a sample daily menu is included to show that student farmers get a good native diet on agricultural stations at the average economic cost of nine pence per day, exclusive of greens and fruit, which to the Fijian in the country may be had at trifling cost.

Five short articles are contributed on local insects, that on the ladybird being of most practical use. The question of the fig moth associated with copra is cleared up for this part of the world, some doubt remaining whether the cacao moth may be shipped in holds from Australia to New Guinea ports. The galls made on kavika leaves by one of the jumping plant lice is also dealt with and identification of some of the associated insects in this complex is awaited from London.

During the hot weather we are now experiencing and may expect till April, houseflies and mosquitoes can easily make life more exhausting and tiresome. It is, therefore, all the more important to take thorough measures to reduce mosquitoes in the vicinity of houses. There is room for much improvement in this connection in Suva, where all Europeans do not set as good an example to other races as they should. The first part of an article by the Medical Officer of Health is worthy both of study and practice, and, in conjunction with the articles on houseflies in the two previous numbers of the *Journal*, should go a long way to reduce these noisome pests to the bare minimum.

AGRICULTURE AND NUTRITION.

By

H. W. JACK, O.B.E., D.Sc., B.A., Director of Agriculture,

and

W. J. BLACKIE, M.Sc., F.I.C., F.N.Z.I.C., Senior Chemist.

THE primary aim of all agricultural development is generally admitted to be the establishment of a balanced agriculture for the production of commodities to be used for direct consumption by the producer and his family or for sale or consumption elsewhere.

In a circular letter in 1939, the Secretary of State for the Colonies stated that in formulating any scheme of agricultural development " importance should be attached to the adequate provision of locally produced food supplies in such variety as the requirements of a balanced and improved nutrition demand."

The outbreak of war so shortly after the above pronouncement greatly emphasised the urgent need of paying attention to the improvement of local food supplies for the people in Fiji and the establishment of sound and balanced systems of crop and animal husbandry.

These matters had already been engaging the attention of the Department of Agriculture for the last few years, and investigations aiming at the general improvement of the standard of living of the Fijians in particular, and also of the Indians, have been progressing slowly.

Amongst such investigations mention may be made of the collection, study and trial of local and introduced varieties of rice; the study of available and introduced pulse crops suitable for inclusion in peasant farming systems; the collection and study of local and introduced varieties of "dalo" (*Colocasia*), tapioca, sweet potatoes, yams, bread fruit, etc.; the study of crop rotations with a view to crop diversification and the maintenance and improvement of soil fertility; the conservation of soil against erosion and mixed farming methods applicable to Fijian and other small holders.

Many of these investigations are still in their initial stages for they cannot be unduly expedited, but it may be stated that the requirements of human nutrition and of improved agriculture go hand in hand and attention to agriculture is bound to effect nutrition beneficially.

This axiom has been the basis of schemes of settlement for individual Fijian farmers whose interest in their lands stimulates a sense of self-reliance and responsibility which in turn creates the desire for diversification of crops and hence of better living standards.

The increasing number of individual Fijian farmers bears testimony to their desires towards self-expression and the staff of the Department of Agriculture strives to assist them with sympathetic and practical guidance as far as possible.

These farmers, with the little assistance that can be given to them, have shown material progress in the past few years, stimulated by the incentive of personal ownership of their lands and the produce they grow, despite market limitations which greatly hamper land settlement. It may be safely stated that individual farmers always have abundant and diverse supplies of food, adequate but not pretentious houses, fair sanitation arrangements and water supplies, while most of them have cash crops and poultry and many have money savings in addition

As an instance of their abundant supplies of food, it may be mentioned that individual farmers within 30 miles or so of Suva marketed in November and December last an additional 130,000 lb of surplus vegetables and fruit which brought them an extra £1,060 in cash, which they quickly put into circulation. Thus they are responding well to the recent exhortations to increase local production.

The Department of Agriculture has also established three demonstration farms in populated areas where rotation cropping and diversification of crops are practised with a view to inducing the natives, by ocular demonstration, to improve their living standards, including a better balanced system of agriculture and its attendant improved nutrition.

Similarly, Provincial training farms are devised to instil into the minds of youthful farming students the need for good cultivation, crop diversification, soil conservation and the production locally of a higher proportion of the essential food products, and it is hoped that abundance of food will lead by variation in the diet to better standards of nutrition. Progress along these lines is giving tangible results in two Provincial training farms though there remains ample scope for much further improvement in the course of time.

The importance of producing more of our local food requirements is stressed in the words of the then Secretary of State for the Colonies in a speech reported in the *Crown Colonist* for August 1939, when he said "The labouring population of the Colonies has not given enough time to the growing of food for consumption in the home market . . . . that is not a sound

policy . . . . one of the things which we have to do in various Colonies is to make the people somewhat less dependent on the returns from export crops. We should encourage them to grow more of their own foodstuffs and to produce more nourishing varieties of local foodstuffs for their own consumption so that they can have fresh vegetables, fresh meat, fresh milk and fresh fruit."

In other words, it is necessary to encourage mixed farming extensively so that fresh protective foods may always be readily available to the farmer and thus render him the more resistant to common diseases. This objective is constantly born in mind by the Department of Agriculture in rendering advice and assistance to small holders for, as stressed in Part I of the report of the Committee on Nutrition in the Colonial Empire, 1939 (paragraph 117), " family production of food to meet family needs is a great safeguard against some of the worst social and economic effects of fluctuations in the income from money crops. There are other reasons too, equally important, why it is most desirable that in every Colonial territory as many people as possible should themselves grow part at least of the foodstuffs that they consume." These "other reasons " include the fact that protective foods are usually more expensive to purchase than other less important foods so that unless they are home-grown they are likely to be neglected and even if they can be purchased, they will not be so fresh as the home-grown commodities. Secondly, wage earners in the Colonies are usually paid at low rates which do not ensure the provision of adequate nutrition for the family. Thus, labourers in Suva tend to depend excessively on trade salmon, white bread and tea, which do not provide a balanced diet necessary for continued healthy existence. Thirdly, compared with the town-dweller who depends mainly on wages, the peasant farmer, with his interest in his homestead usually proves the more dependable and loyal citizen, not only because he has the more to lose if he offends local laws or social customs, but also because he generally possesses more moral stability.

On the experimental stations controlled by the Department of Agriculture, some fifty students are being taught the rudiments of sound general agriculture including animal husbandry, composting, soil conservation and crop rotation. In the provision of suitable food for these field workers much thought has been necessary in order to assure an adequate and balanced diet within the limits of available funds.

In deciding a basic ration scale suitable for native students on experimental stations, many factors had to be considered in addition to the food-habits of the natives and the actual costs per student.

The quantity and quality of the protein constituent must be adequate; the calorific value of the ration must be such as to supply the necessary energy for the duties performed by the students; the minerals, particularly calcium and phosphorus, must be sufficient in amount and in proportionate ration and the vitamins must be provided in sufficient quantity to eliminate any likelihood of deficiency in this respect.

Turning to the consideration of the actual daily needs of an adult worker, nutrition research has revealed that the minimum protein requirements is 70 grammes, but that it is safer to reckon on 100 grammes. Proteins differ in their quality depending on the constituent amino acids, the best sources being meat, milk, eggs, soya bean, dhall, fish, maize, bread, unpolished rice and roots. Proteins of animal origin are more effective than roots and pulses in supplementing those of cereals, and hence to gain an adequate and complete ration of protein it is important that the diet should be varied

The energy required for vital and muscular activity is derived mainly from the carbohydrates and fats in the diet, and in terms of heat units it is estimated that from 2,000 to 4,000 calories per day are required for an adult according to the nature of his work. The foods commonly consumed by Fijians and Indians in this Colony appear to be adequate in this respect.

As regards calcium and phosphorus, the minimum daily dietary requirements are 0·68 grammes and 1·32 grammes respectively, while 12 milligrammes of iron in a suitable form are also necessary for the average adult.

Vitamin requirements appear to vary with the individual, his state of health and his calorific output, but scientific research has indicated that the following daily quantities are adequate: Vitamin A, 3,000 to 6,000 international units; Vitamin B1, 200 to 400 units; Vitmain B2, an uncertain but small quantity; Vitamin C, 100 milligrammes; and Vitamin D, 1,500 to 2,000 units.

With the above normal requirements in view, the following dietary table (Table A) has been drawn up as a basis for regulating the daily ration for students doing field work in experimental stations controlled by the Department of Agriculture:—

TABLE A.

Food.	Protein.	Fat.	Carbohydrate.	Calories.	Phos.	Calcium.	Iron.	Vitamins					Quantity in oz. per day.
								A	B1	B2	C	D	
													ozs.
Meat ..	21·6	14·4	..	280	0·6	0·0	2·4	80·0	40·0	..	..	20	4
Rice (unpol.)	18·4	2·4	168	792	..	0·4	6·4	83·0	80·0	..	..	..	8
Roots ..	24·0	..	480	1,320	0·4	1·6	24·0	8000·0	160·0	..	80	..	40
Bread (wholemeal) ..	43·2	14·4	259	1,264	0·5	0·5	4·8	..	64·0	..	..	..	16
Sugar ..	..	..	60	240	..	..	...	..	..	..	..	..	2
Flour ..	1·6	0·2	12·0	56	..	..	...	..	..	..	..	..	0·5
Onions ..	0·3	..	3·0	11	..	..	...	..	13·0	..	..	..	1
Salt	..	..	..	..	..	..	...	..	..	..	..	..	0·3
Totals ..	109·1	31·4	982	3,963	1·5	2·5	37·6	8163·0	357·0	..	100	..	71·8

In the above table, protein, fat, carbohydrate, phosphorus, calcium are tabulated in grammes per number of ounces of food ingested and calories are tabulated as heat units per number of ounces of food ingested.

Vitamins A and B1 are quoted as corresponding international units and Vitamin C and iron as number of milligrammes ingested for quantity of food consumed

With minor alterations the above table is based on studies carried out at the Central Agricultural Station and appears to have given every satisfaction provided that it is supplemented with fruits and greens as available. The table provides adequate good quality protein and the energy ration is sufficient for the outdoor activities normal to the staff concerned. It is fairly well balanced as an energy diet and, with slight additions to the rice and root components and an ounce or two of butter or ghee daily, would form a good diet for natives on active military service. The minerals and accessory food factors appear to be sufficient in amount but the variation in such components with soil, climate and cooking methods must be considered. The term " roots " includes " dalo," tapioca, yams and sweet potatoes.

Based on the above Table A, the following Table B shows the actual menu given per student at the Central Agricultural Station on the dates indicated and is typical of the normal rations issued which have been found adequate for the needs of students who improve markedly in physique and appearance after a few months at the Station:—

TABLE B.

Date.	Meal.	Food.	Weight.
11/6/40	Breakfast	Bread	1 lb
		Sugar (brown) ..	3·5 oz.
		Lemon leaves	....
	Lunch	Tapioca	3 lb
		Meat (gravy beef) ..	0·5 lb
		Salt	3·0 oz.
	Tea	Rice	0·5 lb
		Sugar (brown) ..	4 oz.
		Lemon leaves	....
12/6/40	Breakfast	Rice	0·5 lb
		Sugar (brown) ..	4 oz.
		Tea	0·1 oz.
	Lunch	Tapioca	3 lb
		Rourou (dalo tops) ..	0·5 lb
		Salt	0·3 oz.
		Coconuts	3 oz.
	Tea	Rice	0·5 lb
		Sugar (brown) ..	4 ozs.
		Lemon leaves	....
13/6/40	Breakfast	Bread	1 lb
		Sugar (brown) ..	4 oz.
		Lemon leaves	....
	Lunch	Tapioca	3 lb
		Meat (gravy beef) ..	0·5 lb
		Salt	0·3 oz.
	Tea	Rice	0·5 lb
		Sugar (brown) ..	4 oz.
		Tea	0·1 oz.
14/6/40	Breakfast	Rice	0·5 lb
		Sugar	4 ozs.
		Tea	0·1 oz.
	Lunch	Dalo	4 lb
		Meat (gravy beef) ..	0·5 lb
		Salt	0·3 oz.
	Tea	Rice	0·5 lb
		Sugar	4 oz.
		Tea	0·1 oz.
15/6/40	Breakfast	Bread	1 lb
		Sugar	4 oz.
		Tea	0·1 oz.
	Lunch	Kumala	3 lb
		Meat	0·5 lb
		Salt	0·3 oz.
	Tea	Rice	0·5 lb
		Sugar	4 oz.
		Tea	....

The diet in Table B was supplemented with fruits (mainly bananas, pineapples and papayas) and greens (China cabbage, lettuce, sweet potato, vines, " beli," etc.) as and when available in small quantities.

Considering the above tables in detail, variety of protein is secured by the addition of meat, bread, rice and roots. Meat can be replaced by fish and maize can replace a portion of rice or bread in providing protein. Bulk is secured by the utilisation of native root foods as much as possible and this is in line with the customary dietary of the natives.

A noteable lack in the food habits of the Fijian is the absence of pulses in the diet, which supply to the Indian valuable sources of protein. Efforts to overcome this lack are directed to the production of soya beans, cowpeas and other bean crops, but progress in this direction is slow as the Fijians show little interest in these foods, possibly because of the extra trouble in cooking them.

The phosphorus, calcium and iron are in a sufficient amount and the ratio of calcium to phosphorus, although not ideal, is within the quantitative limits laid down by nutrition experts. The availability of calcium and phosphorus from vegetable and cereal sources is not as good as for example from milk, but as the diets considered in Tables A and B are for adults only, the matter of calcium and phosphorus assimilation is not as important as it would be in the case of growing children or adolescents, though the addition of milk to students' rations would be a definite improvement and it is hoped will become possible in time. At present milk and eggs are both difficult to obtain and costly but a daily ration of milk and two or three eggs weekly should be added whenever possible.

The Vitamins A, B, and C are in a sufficient quantity, but cooking methods are sometimes wasteful and considerable quantities may be lost in the preparation of food. Fortunately the Fijian steams most of his food, and in the case of dalo and dalo tops, the cooking water is salted and used as a soup or drink. Very little data in regard to Vitamin B2 are available for tropical foods, moreover, standards for B2 (latoflavin or riboflavin) have not been established with certainty. The amounts required are believed to be small and it is considered that adequate quantities are secured in the diets recommended in the above Tables. Vitamin D is essential for the young and occurs in very small amounts only in vegetable products. For adults, a small daily ingestion is essential and this is obtained probably by irradiation of the skin with the ultra-violet rays of sunlight. An important point here is that the long-established native method of oiling the skin and keeping as much as possible of the skin uncovered to sunlight should be and is encouraged amongst student workers. Natives should keep their shirts off as much as is compatible with comfort.

Table A is the basic diet applicable to field workers on agricultural stations who are fairly energetic through long hours but the same Table could well be applied to sedentary workers with a reduction in rice, roots and bread by 15–20 per cent, thus effecting a reduction in the calorific value of the diet to about 3,100, in the Vitamin A value to about 6,000 international units, in the Vitamin B1 value to about 280 international units and in the protein value to about 85 grammes.

The analytical figures upon which the calculations in the Tables are based, are taken from analyses of Hawaiian, Ceylon and Malayan foodstuffs and since variations in vitamins and minerals are to be expected, and are evident from a comparison of available data, minimum values only are recorded in

Table A. The diets concerned are basic only, and it must be made evident that diets should be supplemented with greens and fruits as available. In regard to costs, the diet described in Table A is estimated to require an outlay of 64 pence per unit per week, or nine pence daily, to which must be added greens and fruit which to Fijians living in the country may be procured at a trifling cost, indeed the average Fijian living in the country already consumes a moderate quantity as "rourou" (dalo leaves cooked with coconut milk), spinach of various sorts, bananas, ripe and green (cooked), pineapples, green coconuts, rough lemons, mandarins, oranges and various other fruits seasonally available for the trouble of picking them.

By feeding a balanced ration to student workers, it is hoped that they will later, as peasant farmers continue to vary their food and so maintain a good general balance which will help to engender more resistance to common diseases in the Colony. As the mixed farming advocated by the Department progresses, more protective foods will gradually become available to the native, with whom "the most outstanding dietary deficiency is certainly that of fresh milk" (page 132, *Nutrition in Colonial Empire* 1939, with reference to Fiji).

Conversely, as "the movement towards better nutrition spreads and grows, individual agriculturalists will be encouraged to produce more of the valuable protective foods and their own state of nutrition will, in consequence, rise. In this connexion we attach special importance to the education of the small farmer to the nutritive value of dairy produce." (League of Nations Report, 1937, on "The Relation of Nutrition to Health, Agriculture and Economic Policy." Page 48).

With this end in view small dairy herds have now been established on two of the three agricultural training farms controlled by the Department. These herds are providing instruction in the handling and care of dairy cattle and the students are being served with a small milk ration which, it is hoped, it will be possible to increase in the near future. Thus, the liking for milk and milk products is being stimulated in the students with the hope that they will themselves in time desire to produce these valuable foods for their own families, as well as for sale to neighbours.

It is hoped that these notes will indicate the close linkage which exists between good farming and sound nutrition and their interdependence and the efforts made on agricultural stations to impress their dual importance on young and impressionable students. The diet tables given, which have proved satisfactory for the last 18 months, may also prove useful to other institutions, planters, the Army, etc. with benefit, in particular, to the Fijians as well as to other races.

The authors acknowledge gratefully the essential practical work conducted on the Central Agricultural Station by the Agricultural Officer in Charge, Mr. B. E. V. Parham

"Dalo" = *Colocasia esculentum.* "Rourou" = leaves of dalo in coconut milk as a spinach. "Bele" = *Hibiscus esculentus.*—EDITOR, *Agricultural Journal.*

THE NUTRITION OF PIGS.

By
C. R. TURBET, B.V.Sc., M.R.C.V.S.
Senior Veterinary Officer.

THE probability is that the local consumption of pig products will increase considerably in the near future with a possibility of the development of some export trade in the course of a year or two. Apropos of this, pig raising, when a market exists, can be very profitable if adequate attention is paid to the food requirements of the pig and to general hygiene.

Good sanitation in connexion with pig raising is of such importance that it is expedient to reiterate that commercial pig raising is not possible in Fiji unless special precautions are taken to control the kidney worm. This is done by raising pigs entirely on concrete floors, which are kept clean by daily flushing with water.

Pigs raised in sties which give them protection from sun, wind and rain make better use of their rations and consequently more rapid growth than do pigs allowed free range.

Contrary to popular opinion, pigs being raised for slaughter do not require any greater amount of exercise than they obtain in the sty. Under these conditions, all the food, except that portion used to maintain the body heat of the animal, is utilized to promote growth. The muscles remain tender with a low proportion of fibrous tissue. When free range is allowed, some of the food is used up in providing energy for exercise, the muscles toughen and the proportion of fibrous tissue increases. Exposure to wind and rain, damp ground and worm infestation retards growth and possibly spoils the carcass for human consumption.

As opposed to pigs being raised for early slaughter, bodily vigour should be maintained in the boar and breeding sows. Some exercise is therefore indicated for the boar throughout the year, particularly in dry weather. During the two seasons of the year when the sow is dry, she also should be allowed some free range, being confined in the sty some few weeks before farrowing. After that event and until her piglets are weaned, the sow should remain in the sty. Adult pigs have much greater resistance to worm infestation than young pigs, hence the degree of infestation acquired whilst at free range is usually not sufficient seriously to shorten their effective breeding life.

From what has been written, it will be seen that pigs raised in concrete sties are absolutely dependent on man for their food supply. They have no opportunity to select and thereby balance their own rations. Man, by his skill in feeding, is able so to balance the pig's ration as to secure the maximum growth and the best development of quality. On the other hand, failure to apply the correct principles of feeding or haphazard methods will lead to slow rates of growth, wrong proportion of fat to lean in the carcass, unthriftiness and even death of the pigs.

Scientific and economical feeding requires the provision of a balanced ration, by which the pig is supplied daily with the correct amounts of the various food constituents necessary to maintain bodily health and vigour.

The compounding of a balanced ration necessitates therefore, a knowledge of the composition of the various foodstuffs employed, also of the principles on which the calculation is based. With this knowledge, it is possible by varying the ingredients of the pig's food to fit it with considerable exactness, to the duty which it is required to perform.

Foodstuffs may be regarded as mixtures of complex substances, which, as a result of chemical analysis can be classified into definite substances or groups of substances each of which contributes to the nourishment of the pig. These are (*a*) water, (*b*) proteins, (*c*) carbohydrates, (*d*) crude fibre, (*e*) fats or oils, (*f*) mineral matter (*g*) vitamins.

Water in abundance is essential for drinking as well as for cleaning the sties. It is contained in food to a varying extent—freshly cut grass has a moisture content of upward of 75 per cent, oilcake and various seeds contain about 8 or more per cent. Lack of free water for drinking may be partially balanced by feeding skim milk or green foods.

Proteins are complex substances containing nitrogen, phosphorus and sulphur, in addition to carbon, hydrogen and oxygen. The protein foods are the body builders and they enter largely into the composition of the muscle tissue of the body.

Carbohydrates, such as starches and sugars, are the energy providers. The energy required for body movement, maintenance of body functions and heat is derived from the combustion of carbohydrates within the body. Surplus carbohydrate is converted principally into fat and stored in the body as a reserve.

Crude fibre is derived from the structural framework of plant or animal food. It adds bulk to the food and by filling the stomach helps to satisfy the appetite of the animal. Cattle and sheep are able to digest large quantities of crude fibre because of the specialized form of the stomachs of these animals to deal with this material. The stomach of the pig, on the other hand, is not adapted for the digestion of crude fibre. Too large a proportion of it causes digestive dearrangement and even death. The quantity in various foods differs widely.

Fats and oils.—The function of fat in nutrition is the production of fat and the furnishing of heat and energy. An excess of fat in the ration leads to overfatness of the carcass and in young animals may cause indigestion. Copra contains about 66 per cent of oil whilst good coconut cake or meal contains about 10 per cent.

Mineral matter or ash comprises the inorganic constituents of the food and includes such elements as calcium, phosphorus, iron, iodine, chlorine, sodium, magnesium, manganese, copper and boron. The inclusion of minerals in the food of pigs raised in confinement is essential not only for the formation of bone, blood and other body tissue but also to aid digestion. the absence from the diet of certain minerals or even a badly balanced proportion of some of these, causes disease and even death.

Vitamins are complex organic substances which occur in small quantities in certain foods and without which normal growth would not be possible. They render possible the full utilization of food by the body. From the viewpoint of pig nutrition, the most important Vitamins are A, which is found in green fodder and yellow maize and D which prevents the occurrence of ricketts and is found in plant tissues and fish liver oils.

Nutritive ratio.—The proportion in which protein occurs in any food stuff as compared with the carbohydrate plus the heat equivalent of the fat is called the nutritive ratio. From published tables of analyses of digestible nutrients in the various foodstuffs, it is possible to work out the ratio for any food or combination of foods using the following formula:—

$$\text{The nutritive ratio} = \frac{\text{Carbohydrate} + (\text{fat} \times 2{\cdot}25)}{\text{Protein.}}$$

The closer the nutritive ratio, the more protein there is present. Young animals require a close N.R. of about 1: 4. As they grow older a wider ratio suffices, or in other words, the older pigs require less protein because their rate of growth is slower than with young pigs. It will be seen therefore, that it is essential to supply young growing pigs with rich protein food of a N.R. of about 1: 4 which, as the pigs grow may be gradually widened to about 1: 6 about the time of disposal for slaughter. According to Wolf–Lehmann standards the food required per day per pig at varying ages, etc., is given in the following table :—

TABLE A.

Age.	Live weight.	Dry matter.	Proteins.	Fats and carbohydrates.	Nutritive ratio.
Months.	lb	lb	lb	lb	
2–3	50	2·1	·38	1·50	1:4
3–5	100	3·4	·50	2·50	1:5
5–6	125	3·9	·54	2·96	1:5·5
6–8	170	4·6	·58	3·47	1:6

As an aid to the computation of pig rations, a table of locally available food stuffs computed on a basis of 100 lb of each material is given.

TABLE B.*

Feeding stuff.	Dry matter.	Total digestible Nutrients.			Nutritive ratio.	Mineral ash.
		Crude protein.	Carbohydrate.	Fat.		
100 lb	lb	lb	lb	lb		lb
Meat meal	92·5	58·0	...	12·7	1: 0·6	10·5
Fresh meat	29·0	22·0	...	6·0	1: 0·6	1·0
Fish meal	88·0	39·0	...	7·0	1: 0·4	30·0
Skimmed Milk	9·9	3·1	4·6	0·9	1: 2·1	0·7
Sow's milk	19·0	5·9	5·4	6·7	1: 3·4	1·0
Whole cow's milk	13·6	3·3	4·9	4·3	1: 4·4	0·7
Coconut meal No. 1	90·4	18·8	42·0	8·1	1: 3·2	4·9
Coconut meal No. 2	92·3	18·4	37·6	17·1	1: 4·1	5·7
Wheat bran	89·9	12·5	41·6	3·0	1: 3·9	6·3
Pollard	89·5	13·4	46·2	4·3	1: 4·2	4·4
Cow pea (seed)	88·4	19·4	54·5	1·1	1: 2·9	3·4
Soya bean	90·1	30·7	22·8	14·4	1: 1·8	5·3
Pumpkin	8·3	1·1	4·5	0·5	1: 5·1	0·9
Cabbage	8·9	1·9	5·6	0·2	1: 3·2	0·8
Rice bran (low grade)	90·5	7·1	37·7	7·5	1: 7·7	11·3
Flint maize	87·8	7·7	66·8	4·6	1: 9·9	1·5
Millet	90·7	5·3	49·5	1·6	1:10·0	3·3
Padi	90·4	4·7	64·6	1·7	1:14·6	4·9
Para grass	27·2	0·8	14·0	0·3	1:18·4	6·6
Guinea grass	28·5	1·1	14·1	0·4	1:13·6	2·6
Sweet potato vine	13·0	2·3	6·0	0·3	1: 3·3	1·5
Cowpea vine	16·3	2·3	8·0	0·3	1: 3·8	2·0
Sweet potato	31·0	0·9	24·2	0·3	1:27·7	1·1
Cassava	32·6	0·6	26·4	0·2	1:44·4	1·0
Molasses	74·2	1·0	58·2	...	1:58·2	6·4
Avocado	26·0	2·0	5·0	15·0	1:19·0	..
Green copra	52·0	4·3	9·0	35·5	1:20·6	1·1
Taro root	29·0	1·9	22·0	0·2	1:11·0	..

* Compiled from various sources including *Feeds and Feeding* by Henry and Morrison.

Owing to variation in the availability of the different foodstuffs according to geographical location, it is not possible to devise a single ration for pigs to suit the needs of all pig raisers.

Owing also to variation in age of pigs it is not possible to give in one example the actual quantities to be fed. Reference to Table A, will show the actual quantities as dry matter to be fed to pigs in the various age and weight groups. The quantity fed, however, should be as much as the pigs will consume when fed three times daily. There should be no waste.

In Fiji it is reasonable to group pig breeders into three groups, according to environment as follows:—

A.—Those raised on dairy farms.
B.—Those raised on coconut plantations.
C.—The remainder.

In the case of group A, skimmed milk is the basis on which rations are based. In group B, green copra and "varas" must be included, whilst in group C, rations will contain neither milk nor green copra. Rations suitable for pigs in the different groups will therefore be discussed.

Food for pigs raised on coconut plantations might include any of the following:—Fresh meat, fish, milk, green copra "varas", pumpkin, taro (via), sweet potatoes (roots and vine) cassava, bananas, avocado, cowpea (seed and vine), "vaivai" (*Leucæna glauca*) seeds and foliage.

There is a tendency on the part of some breeders to feed pigs raised on coconut plantations entirely on green coconut. It must be stressed that pigs so fed do not produce the type of carcass required, either for local pork trade or for export for bacon manufacture. The result of excessive coconut feeding is that the pig does not make sufficiently rapid growth. The muscle and bone development is poor, whilst at the same time the carcass becomes excessively fat. This over fat condition is often looked upon by the inexperienced breeder as desirable and correct whilst, in fact, it serves chiefly to mask the otherwise poor development of the animal. Beware then, of over-feeding on fresh coconut.

The following is an example of a balanced ration for pigs of 3-5 months and weighing from 60 to 100 lb when raised on a coconut plantation:—

TABLE C.

	Total weight raw	Dry matter.	Protein.	Carbo-hydrate.	Fat.
Cowpea (seed)	½ lb	·44 lb	·097 lb	·272 lb	·001
Meat (fresh)	1 lb	·29	·22 lb	....	·06
Green copra	2 lb	1·04	·086 lb	·18 lb	·7
Sweet potato tops	3 lb	·39	·06 lb	·18 lb	·009
Sweet potato	2 lb	·62	·018 lb	·48	·006
Pumpkin	10 lb	·83	·11 lb	·45 lb	·05
Mineral mixture	¼ oz.	...	...	...	...
Total ..	....	3·61 lb	·591 lb	1·562 lb	·826 lb
Nutritive Ratio	1:5·5				

Should it not be possible to obtain meat (or fish) the cowpea seeds may be increased to 1½ lb.

An example of a ration suitable for similar pigs raised on a dairy farm would be as follows:—

TABLE D.

Feeding Stuff.	Total feed.	Total dry matter.	Crude Protein.	Carbo-hydrate.	Fat.
Skimmed milk	1gal.	·99	·31 lb	·46	·09
Maize meal	1 lb	·878	·007	·668	0·046
Rice bran	1 lb	·905	·071	·377	0·077
Sweet Potato	1 lb	·31	·009	·242	·003
Sweet potato vine	3 lb	·39	·069	·18	·009
Mineral mixture	¼ oz.	....	....	....	....
Totals ..	....	3·473	·536	1·927	·225
Nutritive Ration	1:4·6				

In the absence of skimmed milk or green coconuts, a ration such as follows may be used for pigs in the same age group.

TABLE E.

Feeding stuff.	Total feed.	Total dry matter.	Crude protein.	Carbon-hydrate.	Fat.
		lb	lb	lb	lb
Cowpea meal	1	·88	·194	·541	·011
Coconut meal	1 lb	·90	·188	·42	·081
Maize meal	½ lb	·44	·038	·334	·023
Rice bran	½ lb	·45	·035	·188	·037
Sweet potato	1lb	·31	·009	·24	·003
Sweet potato tops	3 lb	·39	·06	·18	·009
Molasses	½ lb	·37	·003	·29	....
Mineral mixture	¼ oz.	....	....	....	....
Total ..	....	3·54	·525	2·193	·164
Nutritive Ration	1:4·85				

(*Note.*—If cowpea meal is not available substitute equal quantity of coconut meal or vice versa.)

The aim should be to raise pigs of the desired quality as cheaply as possible. Advantages should be taken therefore of any chance to obtain good food cheaply. Slightly damaged sharps or flour suitable for pig feed is at times available at a cheap rate. A surplus supply of sweet potatoes or bananas provides opportunity for the pig raiser to obtain cheap food. Restaurant table refuse makes rich feeding and any opportunity to obtain this should be utilized, taking care that no harmful matter is included in the material.

Owing to the fact that some foods are procurable in season only, it may be necessary to vary the make up of the diet of any particular lot of pigs. Whenever a change is necessary consult table B (which includes most available foods) to find out the nature of the food unprocurable and select a substitute available foodstuff of similar composition.

The mineral mixture referred to in the rations consists of the following:—

TABLE F.

Sterilized bone meal	40 lb
Air slaked lime	40 lb
Common salt	19 lb
Iron pyrophosphate	1 lb
(Iron sulphate if former is not procurable)	

The question is often asked as to whether cooking increases the value of pig foods. Experiment has shown that from the nutritional point of view there is no advantage to be gained from this practice. Cooking is necessary however, in the case of meat killed on the plantation for pig food. Not only is the meat rendered harmless should it have been affected with tuberculosis, for instance, but it is also sterilized so that even without refrigeration it may be kept for a longer period than raw meat. Cooked meat, unconsumed on one day, may be reheated the following day to preserve it. Some varieties of cassava and even sweet potato tops, at times contain a poinsonous dose of prussic acid. Cooking destroys the poison. It is preferable to feed grain and meal damp or even sloppy rather than dry.

Pig raising must always be more profitable where there is an abundance of food produced on the farm, or is otherwise easily procurable. Assuming that the wholesale market rate of pigs is 7d. per lb dressed weight, it will be seen that production costs must be kept well under that figure if the farmer is to show a profit. At about 156 days the carcass should weigh approximately 96 lb dressed weight and be valued at 56s. By weaning the young pigs at 60 days, 96 days of independent feeding are required to produce the 96 lb dressed weight. If it were necessary to purchase all food supplied to the pigs, an average expenditure of 4d. per day per pig would provide for a gross profit of 3d. per lb dressed weight or 24s. per pig. The majority of breeders will, however, pay every attention to the home production of foodstuffs which are usually more economical than purchased materials.

Local experience indicates that 4d. per day per pig is a fair estimate on which to base food costs in pig raising and though local circumstances must cause variation from this figure, it should provide a moderately safe working basis.

Should any problems arise which are outside the scope of these notes, application should be made to the Department of Agriculture for further advice, which will always be given readily.

THE HANDLING OF TURKEYS FOR THE LOCAL MARKET.

By

C. R. TURBET, M.R.C.V.S., B.V.Sc.,
Senior Veterinary Officer.

THERE appears to be no reason why a fairly regular market for turkeys should not be developed in Suva throughout the year whilst the demand for this type of poultry carcass at Christmas should provide a greatly increased market at that time.

Turkey producers in Taveuni and Lau in the course of the year produce many hundreds of turkeys. Up to the present marketing arrangements and facilities for disposal of their birds have not been well organized. This is partly due to lack of efficient marketing facilities in Suva and partly due to lack of initiative and carelessness in handling the birds on the part of the producers. From the Suva end it would appear to be an easy matter for local cold storage concerns to arrange for the regular receipt of sufficient number of birds to supply the local demand which no doubt is capable of being greatly increased. Producers might notify the Director of Agriculture in the first instance of the total number of birds which can be raised annually for market so that an estimate of the volume of the potential trade might be made.

To develop Suva trade it will be necessary for producers to take more care of their birds, particularly during the period approaching the time for shipment to Suva. Turkeys reared under plantation conditions are often very wild. When captured prior to shipment they often refuse to eat and struggle violently. During the struggle, they are subjected to rough handling and serious bruising of the carcass is likely to occur. This would probably lead to the condemnation of the carcass on slaughter following arrival in Suva.

Birds for shipment to Suva should, therefore, be mustered and penned in a small yard adjacent to the house at least one month before shipment. They should be hand fed and seen frequently so that they become more docile and less likely to take fright and struggle on being handled. When being caught for crating for Suva it would probably be an advantage to catch the birds at night so that struggling may be reduced to a minimum. Crates in which they are to be shipped to Suva should be roomy and comfortable. On arrival in Suva, the birds showing signs of bruising should not be slaughtered at once but should be kept in some convenient enclosure and left to recover before being slaughtered.

PREVENTIVE MEASURES AGAINST MOSQUITOES.

Part I.

By
G. R. BAXTER, M.D., D.P.H., Medical Officer of Health, Suva.

This article is intended to be of use to the ordinary householder in dealing with the mosquito nuisance in his own home and not an exhaustive account of anti-mosquito work.

There are many ways of tackling the problem, but the main line of attack against all insect pests is to seek out and get rid of the breeding places—all the rest is in vain without this essential feature.

1.—Protection from Mosquito Bites.

(*a*) *Ointments and Lotions.*

There are many ointments or lotions which can be used. They are a little messy and smelly, and like onions or garlic they are rather anti-social, but useful for knees or hands and the back of the neck.

Oil of citronella is usually the basis, but this is often difficult to get. Vaseline mixed with a little of almost any essential oil, such as oil of cinnamon, oil of cloves, or vaseline containing about 1 per cent of thymol or camphor, will do as well. These, however, are for the chemists to recommend. For the layman, a freshly cut lime rubbed on the skin can be used. A solution of Epsom salts—1 oz. in half a pint of water dabbed on the skin may be tried. The bite may be rubbed with a little carbolic soap, or dabbed with a little diluted ammonia. "Dettol" also is excellent for reducing irritation from bites and peroxide of hydrogen is another household remedy. These measures are useful to know for picnics—and for people with long out-door night duties in "bush" districts.

(*b*) *Mosquito Boots.*

These must be worn where mosquitoes are abundant and the boots are extremely comfortable. The knees just under the table should be protected. Some mosquito boots are made to come above the knees for this purpose—an essential precaution in malarial countries. It is interesting to note how mosquitoes have almost an instinct for thin skinned portions of our anatomy (ankles and elbows), how they like dark places, how they search out water, and make for animals and human beings.

(*c*) *Mosquito Nets.*

There is a lot to learn about nets or they defeat their object by being stuffy and so may be avoided because they do not fulfil their purpose. Nets should be airy and the oblong type is far better than the draped or Italian type. They should be down by about 5 p.m. The lower edge should be tucked under the mattress and there should be a border of calico about a foot or more wide, all round just above the mattress.

For bush districts a "Sankey house"—a collapsible wooden framework over which a net can be placed is extremely useful. It can be made any size—to hold either a bed, or large enough for a table and chair, etc., in order to read in comfort. There are many simple adaptions of this for out-of-doors in badly infested areas.

2.—Protection from Adult Mosquitoes.

(*a*) *Mosquito-proofed Premises or Rooms.*

Mosquito-proofed houses or quarters are essential in the tropics as apart from the protection from mosquitoes, they provide welcome relief from the continual irritation caused by the usual night-time invasion of moths and other insects.

Screened doors should never open inwards into the room as is sometimes seen, and the same applies to fly-proof doors in meat or fish markets. The reason is obvious.

(*b*) *Anti-mosquito Sprays.*

The ordinary anti-mosquito sprays like "Flit" or "Fly Tox", etc., are too well known to need description. A good formula for a spray is:—

Kerosene	1 gallon.
Pyrethrum powder	½ lb.
Oil of Wintergreen	2 oz.

Mix and stir, leave to settle and strain next morning.

A good spraying once a week gets rid of the old stagers.

Hiding places for Mosquitoes.—The chief hiding places are as follows:—under chairs, desks and tables; behind pictures and furniture which is placed close to the wall; underneath wardrobes, behind heavy curtains and behind clothes in dark corners, behind doors, especially in the bath-room or lavatory, underneath the bath, round the W.C. pedestal and cistern, underneath seats in cinemas, under pews in places of worship, the under surface of roofs of thatched dwellings and the grass walls of native houses. Finally the "boot corner" and open suitcases on the floor seem to attract mosquitoes; these latter are important in connection with air travelling.

In short, they like anything dark, preferably near water, and they are drawn to anything smelling of animals or human beings in their search for blood. Incidentally, it is only the female mosquitoes which have this blood lust. The males have to be content with vegetarian diet and plant juices.

(*c*) *Fumigation Methods.*

These are used mainly for ships, barges and for dwellings infected with mosquitoes. Sulphur may be used, but hydrocyanic acid gas evolved from cyanide units is usual for ships. This must be used only by experienced workers and under suitable and safe conditions.

For domestic use the following methods are recommended:—

(1) Joss sticks which burn like incense can be placed under tables and beds, etc.

(2) Dry insect powder (pyrethrum powder) is occasionally used as a fumigant by burning in closed rooms.

Insect powder scattered on shelves, in cupboards and on floors is invaluable in helping to rid kitchens of cockroaches and ants. It can be cheapened by diluting with powdered borax.

3.—Prevention of Domestic Breeding Places.

Now for the house and the search for breeding places. I must again emphasize strongly that if a room or house is regularly or badly infested so that mosquitoes are obvious or a pest, then if one looks round one should always find the breeding places.

This is what the householder can look for:—

(*a*) *Flower Vases.*

These should be emptied and drained daily. Curled back, over-hanging edges sometimes retain water even when the bowl is inverted, and larvæ may be left in and overlooked.

(*b*) *Anti-ant Devices.*

Receptacles under legs of tables or food safes. These should NEVER contain water, but kerosene, old oil or disinfectant solution. Kerosene on the top of water is not satisfactory because it evaporates and in a little time the water will breed mosquitoes.

(*c*) *Ice Chests.*

Drip bowls catching the water as it drips from ice chests. These should be emptied daily. Sometimes the bowls overflow, and the water on the floor may breed larvæ.

(*d*) *Water Receptacles, Garden Drums, etc.*

In villages, water is often stored in kerosene tins or large water-coolers. A bit of cloth placed over the receptacle and held in place by a board or plate is all that is necessary to exclude mosquitoes. A small lid can be made to fit a kerosene tin at practically no cost, and will keep out mosquitoes as well as small lizards, etc. Water drums or tubs, etc., in the garden, should be fitted with a lid having a central small area of wire mosquito gauze.

(*e*) *Tins and Bottles.*

Tins, bottles, old tyres, coconut shells, anything capable of holding even a small amount of water should be looked for. It is frequently amazing what can be found in this respect. Outside the kitchen, outside the boys' house and over the fence must not be forgotten. Workmen have a habit of dumping old paint cans and oil drums anywhere in the "bush".

The life of a Health Officer in the tropics is one long war against tins and bottles and I am sure these words are muttered in their sleep, and they will be found written across their hearts when they die.

(*To be continued*)

ENTOMOLOGICAL NOTES.

By
R. J. A. W. LEVER, B.Sc., (Hons.), D.I.C., A.I.C.T.A., F.L.S.

1. THE SPOTTED LADYBIRD OF POTATO.

The yellow-winged ladybird with black spots, *Epilachna vigintioctopunctata* F. (often written 28-*punctata*) appears to have been first recorded as a local pest in 1916 (1) when potatoes were grown on a considerable scale at Sigatoka during the last war. Besides the plants recorded in the last issue (2) as being damaged, the grubs and beetles also attack cucumber and black nightshade, (*Solanum nigrum* L.).

The elongate yellow eggs are one-seventh of an inch long and in the writer's laboratory were always laid on the underside of the leaves thus disagreeing with accounts of this beetle in New South Wales (3 and 4) where the eggs are said to be laid on the upper surface of the leaves. Another difference is the habit of the larger larvæ which in Fiji feed on the upper surface of the leaf in contradistinction to Queensland (5 and 6) where "the larvæ are only found on the under surface", this being their position in Fiji during the first instar.

A generation takes on an average 25½ to 28½ days in Fiji in November and December and 19 days elapse between the final ecdysis and oviposition. The life-cycle is as follows at a mean temperature of 77° to 78° F.:—

Incubation period, 4½–5 days; first stadium 4–6; second 4–5; third 4–5; fourth 5–6 days; pupal period 3–4 days.

A dust of one part of calcium arsenate to three parts of finely-ground lime is the best control.

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2. GALL INSECTS OF THE KAVIKA TREE (*Eugenia*).

The formation of galls on plant stems, leaves, buds, flowers or roots used formerly to be attributed to the injury caused by the female insect laying her eggs with, in addition, the injection of a harmful fluid. It is now believed that the feeding of the developing larva within stimulates the extra cell-growth resulting in the formation of the various types of galls. A familiar local example is the contorted appearance of hibiscus leaves whose lower surfaces are covered with warts due to feeding by the mite *Eriophyes hibisci* Nahl.; similarly English readers will recall the oak apple and rose "pin cushion" caused by gall wasps. The chief insects responsible for the many varieties of galls are wasps, flies (gall midges), sawflies (really wasps), aphids (green flies) and a family, little known to the layman, called Psyllidæ which now concerns us.

During the months of December and January the writer examined leaves of the kavika or Malay apple (*Eugenia malaccensis* L.) whose lower surfaces were covered with open reddish warts sometimes numerous enough to form a more or less continuous crust. These growths were found to contain a pale yellow nymph, flattened on the back and curved beneath, which developed into one of the so-called jumping plant lice, *Megatrioza vitiensis*

Kirk. This membranous-winged insect is nearly 3 mm. long and looks somewhat like a miniature cicada; it is said by Dammerman (1) to occur from India to Moluccas though its specific name should have shown it also occurs in Fiji.

The discoverer was F. Muir who took three specimens near the Rewa River in 1906 (2) and it was subsequently taken by C. H. Knowles on leaves of the bread-fruit tree at Lautoka (3). No reference is known by the present writer to its causing the galls on kavika in Fiji, certainly had Muir known it thirty-five years ago he would scarcely have obtained only three specimens when specially collecting these insects. Kirkaldy (3) states that the Hemipterous fauna of Fiji "seems decidedly continental" being Austro-Malayan rather than oceanic in origin and this is borne out by later work. *Megatrioza* must be assumed to have been associated in Fiji with the Malay apple ever since this tree reached the islands; certainly natives know of the occurrence of galls on the leaves of the white variety (kavika vulavula). The insect also occurs in Eastern or American Samoa as specimens were taken by Bryant in 1924 presumably from the galls of *Eugenia* though only the foliage is mentioned (4). This locality was Tutuila Island some 750 miles north-east of Viti Levu.

In Fiji, a caterpillar—which develops into a small brown moth—was associated with the galls but is taken to be secondary. Its identification is awaited from London as is a small brown and yellow moth.

The last insect noticed in this complex is a *Bracon* wasp with dark wings and a brown body and it is taken to be a parasite of *Megatrioza*.

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(3) Kirkaldy, G. W., 1908. *Proc. Linn. Soc. N.S.W.* Vol. 33. Part 2. June.
(4) Crawford, D. L. 1927. In "Insects of Samoa". Part II, Fasc. 1.

3. IDENTIFICATIONS OF INSECTS.

The June issue (No. 2, page 40) contained two clerical errors, viz.:— *Brachylybas "ventricosus"* which should be *variegatus* Le Guill. and *"Cytorhinus"* which should be *Cyrtorhinus*. The first mistake is repeated in the December number, (No. 4, page 117) which should contain an additional pest of yaqona in the transparent coconut scale *Aspidiotus destructor* Sign., fortunately not severe. The same issue on page 99 has the citrus weevil *Rhinoscapha "oblita"* which should be *lagopyga* Frm. a beetle with the apex of the wing-covers cream-coloured entirely with no streak.

In some sacks of coriander seeds received from New South Wales were large numbers of the cigarette beetle *Lasioderma serricorne* L. (No. 4, page 101), parasitised by two minute wasps *Lariophagus distinguendus* Fœrst. and a species of *Bruchophagus*.

4. THE FIG AND COCOA MOTHS (*Ephestia*) IN MELANESIA AND POLYNESIA.

A recent publication (1) by the Department of Scientific and Industrial Research—which was briefly extracted in the last *Journal* (2)—mentions *Ephestia elutella* Hb. (the cocoa moth) as occurring in bagged copra in New Guinea. Since records in Malaya (3), New Guinea (4), the Solomons (5), and Fiji (6) all show that in these regions it is the fig moth (*E. cautella* Wlk.) which is a copra pest, it seemed desirable to investigate the strength of the record of *E. elutella* in Melanesia and Polynesia.

The point is economically important as while the cocoa moth chiefly damages cocoa, chocolate, tobacco and cereals, the fig moth is mainly a pest of dried fruits and such shelled nuts as copra, nutmegs and almonds, being only of minor importance as a grain pest. Further, there was a threat some eighteen months ago that copra from certain Pacific Islands (7) would have to be fumigated at the owner's expense on arrival in Australia owing to heavy infestation by larval *E. cautella*. This contingency resulted in a much needed cleaning up of the driers and bagging sheds in the islands concerned so as to check infestation at the source.

It was established that all *Ephestia* moths from Fiji sent by the writer to London in 1937 and 1939 had been identified by an expert (G. A. Bisset), as *E. cautella* and all local specimens examined in Suva by the author had the *cautella* genitalia as figured by Richards and Herford (8). As Fiji, the Solomons and New Britain are all copra-producing islands between 3° and 19°S., it can be assumed that the introduced insect fauna on prepared copra would most likely be the same in all these regions. Hence it is concluded that, up to the moment, doubt must be cast on any record of *E. elutella* on copra in Melanesia unless it has been carried into these islands with grain in uncleaned holds from Australia where it occurs in large numbers in bagged wheat (1).

This case for its distribution is strengthened by the position in Samoa where *elutella* is also not known to occur(9) though *cautella* is recorded from Upolu Island on dried fruits and other food stuffs. No records seem available from Tonga but the position is probably similar to Fiji and Samoa.

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5. A LEAF-MINING BEETLE—*Promecotheca.*

Besides the coconut leaf-miner (*Promecotheca reichei* Baly) of Fiji, Samoa and Tonga there is in Fiji a jungle species of these brightly-coloured beetles. This is P. *bicolor* Maulik concerning which some errors were made in the paper describing it. Where Maulik has written (1) "feeding on a palm *Flagillaria* sp. 6/1/1927. (R. N. Paine)," one should read "feeding on the liane *Flagellaria indica* L. 6/1/1927 (R. W. Paine)." Another host-plant was recorded in 1938(2), viz. the ivory-nut palm or "soga," *Metroxylon vitiensis* Herm. Wendl. which is the same as Wright's "sogo" or *Sagus vitiensis*(3). This writer, following Seeman, lists *Flagellaria indica* as "duruka" which is really the edible *Saccharum spontaneum*, the liane being "were were" in Fijian.

The eggs are laid in couples under a heap of chewed leaf-fragments on the lower surface of the leaves within which the larval mines are made The adult beetles make grooves on the lower non-waxy side of the leaves which terminate in prehensile tips.

This opportunity is taken of mentioning that Taylor's record(4) of *P. antiqua* from New Guinea should be *P. papuana* Cziki from the Bismarck Archipelago and Bougainville. The same author records *P. opacicollis*

Gestro also from New Guinea but this should be the New Hebrides and Santa Cruz Islands, it having been recorded in the latter group in 1933 (5).

The writer is obliged to the Agricultural Officer, Southern, for help with local plant names.

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CHEMICAL NOTES.

By
W. J. BLACKIE, M.Sc., F.I.C., F.N.Z.I.C., Mem.Soc.Pub.Anal. (Senior Chemist).

FROM time to time the laboratory is consulted by the Police Department in connection with criminal matters involving chemical and physical determinations and the examination of exhibits for clues.

During the last ten years the chemical staff in association with the Criminal Investigation Department has played an ever increasing part in this type of work and many hundreds of cases have been dealt with.

The following notes on a few important cases may be of interest and indicate briefly the scope of the enquires and the methods adopted.

Case No. 1.—Some few years ago, a member of the community disappeared under suspicious circumstances and later a body was exhumed and identified. It was found that the skull had been fractured, the shoulder badly lacerated and the shirt and back pierced with what appeared to be shot marks.

Exhibits from suspected people were forwarded to the laboratory and included an axe, a garden fork, the shot from the back of the deceased and the skull. By careful examination it was proved that small pellets removed from the back of the deceased were soil particles forced in by some sharp instrument and suspicion was riveted on the garden fork. By careful observation it was considered that the garden fork presented for determination of blood-stains had been used in the burial of the body and that the marks on the shirt and back of the deceased had been caused by the fork presented and none other.

The skull bore a triangular gash on the right side; this gash had a small nick on one of the triangular sides and a flattened base. The head of the axe presented for examination fitted accurately into the triangular gash, and a small tongue of metal on the axe had coincided identically with the nick already referred to in the triangular side of the gash. It was therefore proved beyond doubt that the axe and fork presented for the determination of blood-stains had been used by the murderers in the commission of the crime.

Case No. 2.—Small spicules of glass removed from the fæces of several people together with glass obtained from suspected people were forwarded for comparison. The samples were far too minute in size for chemical analysis but by: (i) appearance in ultra violet light, (ii) refractive index determined under the microscope by the Beck method and (iii) the density determined by placing the samples in solution of known density and studying the movement of the glass particles, a satisfactory comparison was effected.

Case No. 3.—Stomach washings and contents were submitted in connection with what was considered to be an accidental suicide case. The person concerned was in the habit of imbibing large quantities of eucalyptus and the post-mortem examination indicated a strong smell of this medicinal. However a complete chemical analysis resulted in the detection of considerable quantities of nitrobenzene (oil of mirbane) together with eucalyptus oil with the result that an accidental suicide developed into a murder charge.

Case No. 4.—A very interesting case with complication occurred some years ago in Fiji. A person died suddenly and at the post mortem definite pathological evidence of a medical nature was adduced for the cause of death. After burial, persistent rumours led to the opening up of an inquiry and toxicological analysis led to the discovery of considerable quantities of strychnine in the viscera.

These four cases, typical of many that come up for examination, indicate the value of chemistry in the elucidation of crime.

A PRELIMINARY INVESTIGATION OF BLUE STAIN IN "KAUVULA" TIMBER.

By
J. L. DESPEISSIS,
Assist. Conservator of Forests.

The following preliminary investigations of the staining of the timber known as kauvula (*Endospermum* spp.) were made possible through the courtesy of Messers. Millers Limited of Suva, who manufacture boxes, particularly butterboxes, from this wood. The butterbox trade is most exacting in its requirements as boxes must be free from taint and clean in appearance. Unfortunately kauvula suffers from two faults: first, an odour, which can however, be eliminated by steaming; and second, a susceptibility to attack by staining fungi which cannot be overcome quite so simply.

Fungal stains vary in colour and origin. Surface moulds may be green, brown, yellow and even black, but are all purely superficial, do not penetrate the wood and may be removed by planing. There is another group of fungi, which penetrates deep into timber and destroys it. These fungi produce stains, but are always associated with decay or breakdown of wood structure. Fortunately, reasonable care in seasoning methods eliminates this group from the timber yard. Lastly, there are fungi sometimes known as "sap-staining" fungi on account of their preference for sapwood with its high starch and sugar content. However, due to the rapid growth of some of the softer timbers here in the tropics, there is not always the same distinction between sap and truewood as would be the case in more temperate regions; so consequently in many cases the whole of a tree is susceptible to attack. A bluish discolouration is the most common result of infection by these fungi which are thus generally known as "blue-staining" fungi. These fungi penetrate the wood but do not cause decay or effect its mechanical properties. They produce a stain, which cannot be removed by surfacing and these stains are caused by several genera of fungi. Under Australian conditions it is known that several species of *Ceratosomella* cause blue stain while in America species of *Penicillium* are responsible for stain.

Timber which has a moisture content of less than 20 per cent of its dry weight, is safe from attack by blue-staining fungi. Air-dry timber has normally a moisture content of approximately 15 per cent and is, conse-

quently, immune from attack. The dangerous period, therefore, is while seasoning is still in progress. There are two methods of protecting timber during this period: either it may be dried quickly by artificial means under conditions which are not favourable to growth of fungi, or else it may be given chemical treatment to protect it during the normal air-seasoning period. Kiln drying is the practical application of the first method and dipping in 3 to 5 per cent borax solution is an effective chemical treatment in the second method. It is possible, by temperature control during kiln seasoning to eliminate the danger of attack. The borax treatment should not be necessary with kiln drying. By comparing the procedure in use here with methods which have proved successful in the control of blue staining eslewhere, it is hoped that a suitable technique for the treatment of kauvula may be evolved. The following notes were made with the hope that they might be of assistance in this respect.

Messrs. Millers Limited recently installed a kiln at their Walu Bay Timber Yard with the object, primarily, of steaming the timber in order to deodorize it and, secondly, of speeding up seasoning. Treatment of timber offsaws with sold solution of 5 per cent borax for several seconds has been made standard practice. This is a combination of the two methods quoted above. The treatment is giving fairly satisfactory results but, in spite of this, blue staining does still occur to some extent.

Six sample boards were selected for observation from a stack of freshly sawn 13 inches x 1 inch kauvula boards about to be put into the kiln for seasoning. The logs from which these boards were sawn had been delivered to the mill freshly cut so that the "offsaws" weight recorded here, may be accepted as true "green" weights.

In an endeavour to eliminate any tree-to-tree variation, the six sample boards were selected in pairs, each pair being derived from a different log and each log from a different tree.

The sample boards were weighed to the nearest half pound. Three of them were then dipped into an open trough containing 5 per cent borax solution for approximately one minute, while three were left untreated. The six boards were then put into the kiln with the remainder of the charge and distributed throughout the stack.

The charge remained in the kiln for seven days, during which time, it was subjected to steam at approximately 200°F. for 24 hours and hot air at approximately 150°F. for 32 hours. The plant operates only during normal working hours and is shut down at night.

On being taken from the kiln the sample boards were weighed again. The whole charge was stacked in the open to air-dry for ten days. The sample boards were then placed separately under cover and weighed again twenty-four days later.

Before the boards were placed in the kiln, and before they were weighed for the first time, samples were taken for an oven dry weight determination. From the figures so obtained, the average moisture content of green kauvula was found to be 83 per cent. of its oven dry weight. From these figures, the oven dry weight of each board was calculated, and hence the moisture content (per cent) on removal from the kiln (on 11th July, 1940), and after 34 days air seasoning (on 14th August, 1940), was determined.

Reference shows that the six sample boards together lost 82 ½lb during the seven days in the kiln and only 6 lb during the subsequent 34 days air-drying. This would appear to indicate satisfactory drying, until it is

noticed that the loss of 6 lb is entirely from boards Nos. 1, 2 and 3 but more particularly from Nos. 1 and 2. The remainder were practically air-dry when removed from the kiln. This indicates either a lack of uniformity of conditions within the kiln or else a variation of physical characteristics between individual trees. The latter possibility may be discounted by the fact that sample board No. 4 does not share this loss with its partner No. 3 and further by the fact that boards Nos. 1 and 2 were placed in the centre of the charge. Uneven conditions within the stack, due to faulty air circulation, almost certainly, therefore, account for these slight variations. After 34 days air-drying, however, the irregularities largely disappeared; the average moisture content being 16·6 per cent, and after an additional twelve days as low as 13·3 per cent, of the dry weight.

TOMATO GROWING ON THE BLACK SOAPSTONE SOILS OF VITI LEVU ISLAND.

By

H. W. SIMMONDS, O.B.E., F.R.E.S.

DURING some eight out of the past twelve years, the writer has endeavoured, with varying results, to grow tomatoes for table use on the Suva black soapstone soils. The main difficulty has been bacterial wilt, which has not only been disastrous in his own gardens but which he has seen wipe out a whole field of several acres in extent.

In his first endeavour to overcome this trouble, the writer tried (1) the use of sulphur in the soil. Some measure of protection seemed to be gained but the plants were poor and little fruit was obtained. Information received from the Imperial Mycological Institute indicated that high acidity or high alkalinity of the soil inhibited the action of the bacillus and the action of the sulphur was probably along these lines.

The next effort (2) was in the opposite direction, i.e. alkalinity, raw soapstone—which contains 12 per cent to 25 per cent calcium carbonate—being broken up and, after weathering for two months or so, planted with tomatoes which were fed with super-phosphate and sulphate of ammonia. Whilst no wilt occurred in this patch it was uncertain whether the protection obtained was due to the alkalinity of the soil inhibiting the bacillus or to its absence on the newly broken rock.

Starting with the knowledge that a high degree of alkalinity was sufficient to destroy the bacillus, it was determined last year to apply lime heavily in small 12-inch circles where the plants were to be placed and then, a week prior to planting, to apply super-phosphate to help correct the alkalinity, with further correction later by the very limited use of sulphate of ammonia. The results were remarkable. Out of 42 plants which did not receive treatment, fifteen died of wilt, whilst all were poor fruiters and yellowish in foliage. Of the 123 which received the lime treatment, only four died of wilt, whilst the average crop was at least four times that of the untreated plants, the fruit being of the highest class and flavour.

Further, in the untreated area the soil where twelve of the plants had died was subsequently treated with lime and replanted in the same holes. Of these, nine produced good plants, yielding well, whilst again three died. Of the forty-two plants put into untreated soil not only did fifteen die of wilt, but of the balance nineteen were removed because of their failure to set fruit.

The experiments were conducted purely as gardening routine and not as scientific experiments, the pH values not being taken, whilst at the commencement no notes were kept of varietal differences. The results were, however, so satisfactory and encouraging and the quality of the fruit produced has been so high, that pending further work on the lines suggested, a note seemed worthy of publication.

Generally speaking, the seed was sown at the stake and, in addition to the treatment recorded, wood ashes were liberally supplied. All fruit should be covered with mosquito net or cloth bags as it approaches maturity to prevent attacks by bulbuls and the green bug (*Nezara*). The quantity of lime applied was slightly over one pint per hole.

The varieties grown were Break O' Day, Sutton's Best of All, Stone and Pritchard. Of these, Best of All gave the most even bunches of fruit of commercial type and size.

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A PREDATORIAL WASP OF COCKROACHES.

By
H. W. SIMMONDS, O.B.E., F.R.E.S.

Ampulex compressus F. is a beautiful green Sphegid recorded from India, Reunion and Mauritius where it preys upon large cockroaches which it partially paralyses, when it is able to lead its dazed, but still active, victim to a suitable hole where it presumably uses them to oviposit upon. No work seems to have been done upon these insects and there is little exact information concerning them. The scarcity of cockroaches in Mauritius as compared to their abundance in Samoa* suggests that, if obtainable, this might prove a valuable introduction. Unfortunately however, the insect disappeared with the advent of cold weather, shortly after the writer arrived in Mauritius [April, 1939].

Longevity tests were carried out with the only pair available, using honey-agar as food and keeping them in lamp glasses. The male only lived a few days, but the female did exceedingly well, being active after 55 days confinement when the writer left for Madagascar and he was informed that it survived 80 days. There should be no great difficulty in transporting this species by air from Mauritius to Fiji when they again become available. Its introduction is recommended the more so that it is a species which hunts its prey in buildings and, being very long-lived, would probably make good from a limited colony.

*And Fiji—EDITOR.

TREE-PLANTING ALONG THE KING'S ROAD.

By
W. L. PARHAM,
Agricultural Assistant.

As the tree plantings along the King's Road are becoming conspicuous in places some notes on the subject seem justified.

The records show that consideration was being given to amenity plantings along the proposed trans-insular road in November, 1933.

In 1935 eight hundred seedlings were supplied by the Department of Agriculture and these were mostly planted by the Public Works Department

at Nayavu or along the road in that vicinity. In 1938 the writer was instructed to care for the roadside trees and 135 trees were found to have become established. By a system of progressive prunings the trees have been improved. It was found that from Bouva to Nayavu 67 resupplies were necessary. This indicates a loss of approximately 40 per cent for that section which is satisfactory considering the difficulties.

Except for £5 granted by the Forestry Department in 1939, any work done has had to be carried out by salaried assistants as convenient and in conjunction with other duties. Apart from the care of the Nayavu trees originally planted by the Public Works Department, tree-planting activities of the Department of Agriculture in the Central District are summarized below:—

1936—Establishment of seed supply and of a nursery in Ra.
1937—364 trees established, including commencement of afforestation plots on roadside. Nursery lines established in Tailevu.
1938—2,282 trees established.
1939—1,080 trees established.
1940—172 trees established.

It is noted that the large plantings in 1938 involved much maintenance and resulted in reduced plantings later. Much importance was attached to the obtaining of uniform lines of trees.

Difficulties encountered in this work have been referred to above and some account of these may be of interest.

Selection of suitable trees was not easy, The need for an early show of results caused the utilization of a proportion of fast growing hardy trees. Local differences in climate, soil, and degree of exposure to sun and wind were all regarded. Scattered plantings of this type cannot be given ordinary after-care, such as watering, so nursery lines were established to facilitate planting during favourable weather. This also enabled the formation of good root systems.

Selection of sites is not easy. Obscuring of the view at bends has to be avoided and possible changes in the road anticipated. For instance where the road parallels the river the writer preferred to plant on the riverside as any widening of the road could hardly affect trees so placed. Service to the travelling public was kept in view and trees planted at favoured stopping places as for instance at the streams near Natokalau village.

Apart from the need for weeding, backward trees had to be given "whips" of sulphate of ammonia, and a constant watch kept for trees injured by vandals or by stock. Apart from thefts, fire, careless weeders, etc., trees were damaged by cattle being tethered to them or even in one case by being utilized as fence posts. The co-operation of the road overseers and of the police was most helpful.

The present position is that the initial plantings made by the Senior Road Overseer at Nayavu and many trees planted by the Department of Agriculture at Korovou, Waimaro, the Vunidawa Road intersection, Naokalau, and Dobuilevu have grown beyond the reach of all except the most deliberate vandals. Also at Korovou, Waimaro and Dobuilevu useful small afforestation plots are well established. At three banana packing stations trees are already beginning to provide useful shade.

In conclusion, some reference must be made to the many owners of road frontages who have not spared expense to beautify their road boundaries, and in some cases have assisted the writer with planting material.

CASSAVA FLOUR.

By

C. J. DASS, Indian Field Assistant.

WITH a view to the use of more locally produced foodstuffs, preliminary trials were recently made of mixtures of cassava flour and wheaten sharps as a means of reducing the consumption of sharps. "Chapatis" were made by experienced Indians, using mixtures of (*a*) one part of cassava flour to two parts of sharps and (*b*) one part of cassava flour to one part of sharps.

The mixture (*a*) was kneaded with cold water and ghee was added, and the resulting "chapatis" were unattractive in colour, rather crumbly, but of good flavour.

The mixture (*b*) was kneaded with warm water without admixture with ghee, and the "chapatis" were reported as being soft, not crumbly, of good flavour and good appearance. Thus, a mixture of equal parts of cassava flour and sharps proves satisfactory and could provide a material saving in the import of sharps.

Both dalo and cassava flour as well as maize meal have been utilized quite freely and satisfacorily in the last few months in some districts as a substitute for sharps, or in admixture with sharps, although the average Indian definitely prefers sharps alone when funds are available to purchase it.

LOCAL MAIZE MEAL AS A FOOD FOR STOCK.

MAIZE is, at the time of writing (February, 1941), selling at 7s. for a 2-cwt. bag at Sigatoka and at approximately similar prices in Ra and Tailevu. Landed at Suva, this is equivalent to 9s. a bag, but as there is usually some loss in weight, due to drying out of the maize, the cost is better taken at 10s. There are mills at Suva, Nadi and Ba, where maize can be ground to a fine meal at a cost of from 9d. to 1s. per tin, equivalent to 2s. 3d. to 3s. per cwt. Thus at the present time poultry and stock farmers near Suva can obtain supplies of maize meal at a cost of approximately 8s. per cwt. and elsewhere at costs varying according to distance from source of supplies of maize

Maize fluctuates considerably in price according to season, and may rise to as much as £1 per 2-cwt. bag. At this price it is prohibitive as a stock-feed, but for most of the year it fluctuates around 10s., which is equivalent to meal at say 9s. per cwt. The demand for maize in New Zealand has led to the development of a small export trade; this should further encourage production, with consequent benefit to local consumers.

The value of maize as a feed for animals is well known. In its whole state, nevertheless, it is unsuitable for feeding to small chickens, young pigs, calves and to dairy cows. By the ordinary process of cracking, its nutritive value is improved somewhat. It is more easily digested and its nutritive value is greatest, however, when it is reduced to a fine meal. Its use in this form is strongly recommended to poultry raisers, pig breeders and to dairy farmers.

Yellow maize, the type grown in Fiji, is particularly rich in vitamins. It contains the various nutritive compounds in the following proportion per 100 lb: crude protein 7, carbohydrate (or starch) 69, fat 3·5 and mineral ash 1·3. On an average, the quantity of maize meal to feed would be about one-third of the total ration. Since maize meal is comparatively rich in carbohydrate content, it should be fed combined with a food rich in protein. Such foods are skimmed milk, cowpea, coconut meal and fresh young grass.

—C.H. AND C.R.T.

LOCAL VEGETABLE PRODUCTION.

Through the organization of the Department of Agriculture, 110,078 lb of vegetables and fruits were supplied to the local forces in the Suva area between 1st November and 31st December last. Practically the whole quantity was produced by Fijians, who benefited to the extent of over £566.

—H.W.J.

LOCALLY PRODUCED PRESERVES.

At the Fiji Agricultural Show held in Suva in October last, one of the most striking exhibits was a collection of preserves prepared by Mrs. A. M. Corbett of Suva.

The collection inluded preserved fruits and vegetables, pickles, chutneys, sauces, vinegars, syrups, juices, jams, jellies and marmalade. This comprehensive list indicates the wide scope that exists for the provision of such products in the Colony.

The following are the details of the exhibits:—

Fruits.—Wi, bananas, kumquats, Indian cherries, fruit salad, mangoes, pawpaw, passion fruit, pineapple (sliced and crushed) tomatoes, rhubarb, soursop, granadilla, shaddock and guavas.

Vegetables.—Beetroot, carrots, parsnips, chokos, French beans, peas and cabbage.

Pickles.—Chillies, mixed pickles, tomato relish, onions, cucumbers, red cabbage, limes, eggs, beans, mustard and mixed pickles.

Chutneys.—Mango, wi, pawpaw and choko.

Sauces.—Tomato, pawpaw and wi.

Vinegars.—Soursop, orange, wi, banana and lemon.

Syrups.—Orange, lime, lemon and mandarin.

Juices.—Tomato and pineapple.

Jams.—Mango, guava, wi, cherry, pawpaw, granadilla, lemon and melon.

Marmalades.—Poorman orange, orange, kumquat and grapefruit.

Jellies.—Wi, guava, cherry and granadilla.

Crystalized citron peel.

The advantages of the preservation of fruits, vegetables, pickles, syrups, etc., are obvious in the provision of nutritious products all the year round although most crops are seasonal and may only be available in abundance for very brief periods.

Many of the products exhibited had retained their natural colour and were thus of appetizing and pleasing appearance.

In these times it is desirable that more use should be made of locally grown produce and in this connexion Mrs. Corbett will be pleased to assist interested persons with directions as to the processes she has used so successfully in making the above preserves.

In country districts in particular there should be ample scope for the preservation of fruits and vegetables in season for family consumption all the year round and it is therefore hoped that Mrs. Corbett's efforts will stimulate others to follow her good example.

—H.W.J.

REVIEW.

CONTROL OF GRAIN WEEVILS IN AUSTRALIA.

THE last issue of the *Journal* contained an extract and a review on destruction of grain and other stored foodstuffs by insects and no apology is made for this review on what is being done at the moment in Australia. Although the three authors* are concerned with weevils of wheat, one serious Australian grain pest (*Calandra oryzæ*) is abundant on rice in Fiji and its damage provides other beetles (*Tribolium* and *Oryzæphilus*) with food on the broken grains, meal and flour destroyed by the weevil which is the primary pest, the others being secondary.

The campaign against wheat weevils carried out in Australia during the years 1917–19 has been described as the greatest battle man has had to fight against stored grain pests anywhere, at any time. The experience gained during those two years "brought to light no practicable method of preventing weevil infestation other than by the meticulous observance of what may be termed hygienic principles in all stages of the handling process. These principles involved (*a*) the selection, where possible, of clean stacking sites well clear of old wheat yards, (*b*) the use of clean dunnage, (*c*) the use of hessian or a wheat-proof floor to prevent weeping wheat from trickling down to the ground below the stacks, (*d*) good roofs and good curtains, held clear of the wall bags, to protect the stacks from weather, (*e*) adequate protection from mice in areas where these rodents are likely to be numerous, and (*f*) the location of holding depots in places away from the seaboard, and the rapid transference of the wheat to these depots from country sidings. These precautions were based on a recognition of the facts that some weevils manage to hang on from season to season on or near annually used stack sites, often in the crevices of old timber used for dunnage; that wheat wet by rain or which has become moist from lying on the ground is particularly liable to attract and breed weevils; and that the relatively humid climate of the seaboard favours weevil activity. Where the necessary precautions were taken, serious weevil trouble was usually avoided".

Further, the main trouble in clearing up was always the floor of the storing sheds and the absolute desirability of having good insect-proof floors in any shed used for storage of grain was demonstrated and concrete was recommended. These lessons are being applied now over twenty years later and are of universal application.

All this goes to show that the key to weevil control, where large quantities of grain are stored, is thorough cleanliness throughout. Were a more attractive or novel remedy suggested people would be more likely to carry out the measures than where they are routine, irksome and non-spectacular.

—R.J.A.W.L.

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